

# THE MINERAL INDUSTRY OF

# FINLAND

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The mineral resources of Finland include some 50 metals and 30 industrial minerals, as well as gems and soapstone. The Government encouraged foreign investment in mineral exploration and exploitation. Foreign and domestic companies were active in exploring for base metals, diamond, and gold. Finland was a world leader in the technology of underground mining, mineral processing, and metallurgy. The country imported metal concentrates from various sources to feed its smelters and was a net importer of these.

Finland's rapid economic growth with a 6% increase in gross domestic product in 2000 was fueled by an export boom, which grew by more than 9%. The country's forestry sector was at full capacity and the electronics sector was continuing to capture new markets abroad. Domestic demand for products and services, however, was surprisingly subdued. The inflation rate was one of the highest in the European Union.

The Government backed a proposal to sell its shareholdings of 39.9% in base metals and stainless steel producer Outokumpu Oyj and 40.1% in steelmaker Rautaruukki Oy. It also proposed to divest the 53.4% stake in the chemical company Kemira Oyj and reduce to below one-third the 75.4% interest in the oil company Fortum Oil and Gas Oy. The Ministry of Trade and Industry is in charge of privatization (Metal Bulletin, 2000a).

The local engineering firm Kumera Corp. intended to build a new aluminum smelter in Finland with a capacity of 230,000 metric tons per year (t/yr) if the Government allowed the construction of a fifth nuclear reactor powerplant in the country and the use of inexpensive energy. World demand for aluminum would increase during the next 10 years (Market Watch, March 11, 2000, Finland may acquire new 230,000 aluminum smelter, accessed August 18, 2000, at URL <http://www.alunet.net/shownews.asp?ID=476&type=1>).

Outokumpu and Somincor of Portugal negotiated a 3-year copper concentrate contract. Outokumpu also was looking at converting its Harjavalta nickel smelter to producing copper in the next few years, once nickel feed stocks had run out at Black Swan, Cygnet, and other nickel mines (Metal Bulletin, 2000c).

Outokumpu Steel's merger with Avesta Sheffield of Sweden was approved by the European competition authorities. It also was approved by competition authorities in the United States and Canada. The new company, AvestaPolarit, would combine the stainless steel operations of the two companies with a slab capacity of 1.7 million metric tons per year (Mt/yr). Outokumpu would own 55% of the new company, and Avesta Sheffield's shareholders, 45%. AvestaPolarit's main production facilities would be in Finland, Sweden, the United Kingdom, and the United States (Engineering & Mining Journal, 2000c).

Outokumpu was to double stainless steel slab production at Tornio to 1 Mt/yr at a cost of \$570 million. The investment included a new melting shop with an electric-arc furnace, converter, and continuous casting equipment, as well as a new plant for the rolling mills. The 3-year project was expected to reach full capacity in 2004 (Mining Journal, 2000b).

Rautaruukki started commercial production at its 400,000-t/yr galvanizing line at Hameenlinna. The \$590 million plant came on-stream in April and increased the company's galvanizing capacity to 900,000 t/yr. Rautaruukki also spent \$80 million in raising color-coating capacity at Hameenlinna from 100,000 to 150,000 t/yr (Metal Bulletin, 2000e).

OM Group, Inc. (OMG), of the United States purchased Outokumpu's 50,000-t/yr Harjavalta nickel refinery—including nickel matte leaching, solvent extraction, electrowinning, and hydrogen reduction facilities—for \$185 million. OMG has production facilities at Kokkola processing part of the nickel and all of the cobalt produced at Harjavalta. The Harjavalta nickel refinery would continue to supply nickel to Outokumpu's Tornio stainless steel operation. Outokumpu would continue to smelt nickel concentrates from its own mines and toll smelt concentrates for OMG. The Hitura nickel mine was reopened in 1999 and remained open with production of 3,500 t/yr of concentrate. When Outokumpu's nickel reserves were depleted, it planned to withdraw from the nickel business and focus its metal production activity on copper and zinc (Engineering & Mining Journal, 2000b).

OMG began assembly work on a new solution purification line in the nickel extraction/reduction plant at Harjavalta refinery. The company planned to invest \$600 million to \$700 million on new equipment and machinery for the plant. Pure nickel solution was used in the production of nickel chemicals that would be used in batteries and cellular phones (Metal Bulletin, 2000b).

Gold Fields Ltd. and Outokumpu reported an initial 90,000-kilogram platinum-group-metal resource on joint-venture lands south of Rovaniemi in northern Finland. The resource was reported for the Ahmavaara and Konttijarvi areas in the Portimo Complex. Their Arctic Platinum Partnership was announced in March. Preliminary analysis suggested that substantially all the above resource might be extractable by open pit mining methods at an overall stripping ratio of 2 to 1 (Engineering & Mining Journal, 2000a).

Tertiary Minerals plc made two claim reservations in Finland for the rare metals tantalum and cesium and commissioned the Finnish Geological Survey to complete a confidential study into the potential for rare metals mineralization. The first claim reservation covered a pegmatite on Kemio Island in southwest Finland. The second was made over the Viitaniemi pegmatite in the Erajarvi district of southern Finland (Mining Journal, 2000a).

Belvedere Resources Ltd. of Canada completed a 1,240-meter, five-hole diamond drilling program on its Arkala property in central Finland which lies in the main sulfide belt, 10 kilometers (km) north of Outokumpu's Pyhasalmi Mine. Recent extensive bedrock sampling and old drill data defined a large alteration zone 3 km long. Two of the drill holes intersected disseminated sphalerite mineralization. Further followup drilling and bedrock sampling was planned (Canada

NewsWire, October 4, 2000, Belvedere Resources Ltd. announces update on recent drilling, accessed October 5, 2000, at URL <http://www.newswire.ca/releases/October2000/04/c0208.html>).

Outokumpu planned to acquire Norzink (owned by Rio Tinto plc and Boliden Mineral AB) in October and extended the term of its letter of intent till the end of January 2001. The extension was needed to enable the parties to finalize negotiations. Norzink operates a 150,000-t/yr zinc smelter and refinery near Odda, Norway. Outokumpu would pay \$180 million for expansion project to 260,000 t/yr of zinc metal at its Kokkola zinc plant, which was due to come into production in 2001 (Engineering & Mining Journal, 2000c).

Industrial actions by workers in the chemicals industry affected production at Kokkola zinc refinery. The roasting process at the zinc plant was shut down on March 17. The intermediary stocks enabled the plant to continue producing zinc for a week. The plant produced some 600 metric tons per day of zinc, or about 225,000 t/yr (Metal Bulletin, 2000d). Outokumpu reported zinc production ran smoothly with 7% more zinc produced in the second quarter than during the same period in 1999.

The construction of a gas pipeline between Russia and Finland on the Baltic seabed might be finished by 2010. In 1998, Gazprom and Fortum set up a joint venture, NordTransGas Oy, to make a feasibility study and work out a business plan for the project. The overall cost of the project was estimated to be \$10 billion (Petrodata-Petrodaily, August 3,

2000, [untitled], accessed August 14, 2000, at URL <http://www.petrodata.co.uk/CGI/tbcgi.exe?CGILATEST>).

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## Major Source of Information

Geological Survey of Finland  
Betoniimiehenkuja 4  
02150 Espoo  
Finland

TABLE 1  
FINLAND: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/	1996	1997	1998	1999 e/	2000 e/	
<b>METALS</b>						
Aluminum metal, secondary	35,308	38,200	40,500 r/	43,989 r/ 4/	43,200 4/	
Cadmium metal, refined	648	650 r/	520 r/	700	700	
Chromite:						
Gross weight:						
Lump ore e/	thousand tons	210	215	220	225	230
Concentrate e/	do.	360	365	380	400	400
Foundry sand e/	do.	12	9	10	10	10
Total	do.	582	589	610	635	640
Cr <sub>2</sub> O <sub>3</sub> content						
Lump ore e/	do.	70	75	75	75	80
Concentrate	do.	150	150 e/	150 e/	150	150
Foundry sand e/	do.	3	3	5	5	5
Total	do.	223	228	230	230	235
Cobalt, metal, powder, and salts	4,160	5,000	5,250	6,200 4/	7,700 4/	
Copper:						
Concentrate, gross weight	24,000	22,000 e/	25,000 e/	28,000	29,000	
Mine output, Cu content	9,261	8,500 e/	9,500 e/	10,500	11,600 4/	
Metal:						
Smelter	178,675	159,000 e/	156,000 e/	149,600 4/	155,400 4/	
Refined	110,715	116,000 e/	123,000 e/	114,700 4/	114,000 4/	
Gold metal	kilograms	3,070	3,900	5,000 e/	5,900	5,000
Iron and steel, metal:						
Pig iron	thousand tons	2,457	2,786	2,912	2,954 4/	2,983 4/
Ferroalloys, ferrochromium	do.	228	237	231	256 r/ 4/	261 4/
Steel, crude	do.	3,301	3,687	3,932	3,956 4/	4,096 4/
Semimanufactures, rolled	do.	3,292	3,314	3,682	3,700	3,750
Mercury		88	63	54	40	45
Nickel:						
Mine output, Ni content		2,136	3,252	1,967 r/	8,079 r/ 4/	2,600
Metal, electrolytic		28,815	34,228	46,200	51,948 r/ 4/	15,300
Platinum-group metals:						
Palladium	kilograms	182	180 e/	150 e/	150	150
Platinum	do.	62	60 e/	50 e/	50	50
Selenium metal	do.	42,000	28,000	28,000 e/	26,000	26,000
Silver metal	do.	32,506	32,500 e/	29,700 e/	31,500	23,600
Zinc:						
Mine output, Zn content		26,294	30,800 e/	30,700 e/	20,000	16,200
Metal		176,300	175,000 r/ e/	199,000 e/	225,200 r/ 4/	223,000
<b>INDUSTRIAL MINERALS</b>						
Cement, hydraulic	thousand tons	975	905	903	1,310 r/ 4/	1,350
Feldspar		40,265	40,000 e/	40,000 e/	40,000	40,000
Lime	thousand tons	394	400 e/	400 e/	305 r/ 4/	400
Nitrogen, N content of ammonia		5,107	6,000 e/	6,000 e/	6,000	6,000
Phosphate rock, apatite concentrate:						
Gross weight	thousand tons	667 r/	690 r/	716 r/	724 r/	700
P <sub>2</sub> O <sub>5</sub> content	do.	246 r/	254 r/	260 r/	268 r/	250
Pyrite, gross weight	do.	813	950 e/	900 e/	800	800
Sodium sulfate	do.	29	30 e/	35 e/	30	30
Stone, crushed:						
Limestone and dolomite:						
For cement manufacture	do.	1,128	1,200 e/	1,200 e/	1,350 r/	1,300
For agriculture	do.	892	900 e/	900 e/	1,000 r/	1,000
For lime manufacture	do.	303	300 e/	300 e/	350 r/	350
Fine powders	do.	289	300 e/	300 e/	350 r/	350
Metallurgical e/	do.	2	2	2	1 r/	1
Total	do.	2,614	2,700 e/	2,700 e/	3,050 r/	3,000
Quartz silica sand	do.	31	30 e/	30	73 r/ 4/	70

See footnotes at end of table.

TABLE 1-Continued  
FINLAND: PRODUCTION OF MINERAL COMMODITIES1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/	1996	1997	1998	1999 e/	2000 e/
INDUSTRIAL MINERALS--Continued					
Sulfur:					
S content of pyrite thousand tons	425	373 r/	430 e/	500	500
Byproduct:					
Of metallurgy do.	291	307 r/	296	300	300
Of petroleum do.	38	50 r/	40 e/	45	50
Total do.	754	730 r/	766 e/	845	850
Sulfuric acid do.	1,287	1,200 e/	1,200 e/	819 r/ 4/	800
Talc do.	345	350 e/	350 e/	469 r/ 4/	360
Wollastonite	22,304	20,000 e/	22,000 e/	22,000	20,000
MINERAL FUELS AND RELATED MATERIALS					
Peat:					
For fuel use thousand tons	7,000 r/	9,500 r/	1,700 r/	4,140 r/ 4/	7,000
For agriculture and other uses do.	300 r/	600 r/	150 r/	1,595 r/ 4/	400
Petroleum refinery products thousand 42-gallon barrels	83,000	76,643	83,370	83,000	80,000

e/ Estimated. r/ Revised.

1/ Table includes data available through June 19, 2001.

2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ In addition to commodities listed, granite and soapstone are produced, but available information is inadequate to make reliable estimates of output levels.

4/ Reported figure.

TABLE 2  
FINLAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Apatite	Kemira Agro Oy (Government, 98%)	Mine and plant at Siilinjärvi	8000
Ammonia	Kemira Oyj (Government, 98%)	Plant at Oulu	75
Cadmium, metal	Outokumpu Oyj (Government, 40% ; private investors, 12.3%)	Smelter at Kokkola	1
Cement	Finncement Oy (Irish Cement Ltd., 100%)	Plants at Lappeenranta and Parainen	1,020
Chromite	Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Mine at Kemi	1000
Copper:			
Ore, Cu content	do.	Mines at Pyhäsalmi, Saattopora, and Hitura	10
Metal	do.	Smelter at Harjavalta	160
Do.	do.	Refinery at Pori	125
Feldspar	SP Minerals Oy (Partek Corp., 50.1%; SCR-Silbeco SA, 49.9%)	Mine and plant at Kemiö	50
Ferrosilica	Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Smelter at Tornio	250
Gold:			
Ore, Au content	tons do.	Mine at Orivesi	4
Metal	do. do.	Smelter at Pori	4
Ore, Au content	do. Williams Resources Inc.	Pahtavaara Mine near Sodankylä	3
Limestone	Partek Nordkalk Oy (Partek Corp., 100%)	Mines at Lappeenranta, Pargas and Parainen	1,500
Do.	Rauma-Repola Oy	Mine at Tornio	300
Mercury	tons Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Smelter at Kokkola	150
Mica	Kemira Oyj (Government, 98%)	Mine at Siilinjärvi	10
Nickel:			
Ore, Ni content	Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Mine at Hitura	3
Metal	do.	Smelter at Harjavalta	32
Do.	OM Group, Inc.	Refinery at Harjavalta	50
Petroleum products	Fortum Oil and Gas Oy	Plants at Naantali and Porvoo	NA
Phosphate-apatite	Kemira Oyj (Government, 98%)	Mine at Siilinjärvi	700
Do.	Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Mine at Pyhäsalmi	800
Quartz and quartzite	SP Minerals Oy (Partek Corp., 50.1%; SCR-Silbeco SA, 49.9%)	Mines at Kemiö and Nilsia	250
Selenium	tons Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Smelter at Pori	35

See footnotes at end of table.

TABLE 2--Continued  
FINLAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Silver	tons	Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Smelter at Pori	30
Steel		Rautaruukki Oy (Government, 41.8%)	Plant at Raahe	2100
Do.		Fundia AB (Norsk Jenverk AS of Norway, 50%; Rautaruukki, 50%)	Plants at Aminnefors, Dalsbruk, and Koverhar	850
Do.		Ovako Oy (SKF, 50%; Wartsila, 25%; Fiskas, 20%)	Plant at Imatra	600
Stainless		Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Plant at Tornio	500
Talc		Mondo Minerals Oy (Western Mining Corp. Holdings Ltd., 50%; Plüss-Stauffer AG, 50%)	Mines at Lahnaslampi, Lipsavaara, and Horsmanaho	500
Wollastonite		Partek Minerals Oy (Partek Corp., 100%)	Mine at Lappeenranta	30
Zinc:				
Ore, Zn content		Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Mine at Pyhäsalmi	25
Metal		do.	Smelter at Kokkola	175

NA Not available.